ESTIMATION AND INTERPRETATION OF CAPITAL GAINS REALIZATION BEHAVIOR: EVIDENCE FROM PANEL DATA [1]

by

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I. Introduction

The revenue effects of capital gains taxation have important implications for the extent to which capital gains taxes can be modified to achieve policy objectives. But the existing economic evidence on capital gains taxation is so imprecise that there is widespread disagreement about whether past changes in the taxation of capital gains raised or lost revenue and about what the direction and magnitude of the revenue effect of proposals to cut the tax rate on capital gains might be.

There are three primary reasons why economists can't answer policymakers questions about the revenue implications of capital gains tax changes with more certainty. First, the econometric analysis of capital gains realization behavior has only weak theoretical economic foundations. Absent a clear behavioral model, econometric analysis is as much art as science and artistic interpretations clearly vary on this subject.

Second, it is unclear what kind of data set is adequate for answering policymakers' questions. It is possible that cross-section and time series data sets answer different kinds of questions. However, there is considerable confusion and dissent among economists about which kind of data are appropriate. Moreover, previous studies have lacked important explanatory variables, such as state tax rates and accrued capital gains, that may have added to the uncertainty of their analyses.

Third, previous studies have been hampered by econometric problems. Most notably, while virtually all studies have recognized that the marginal tax rate on capital gains is determined simultaneously with the level of capital gains, these studies have ignored the endogeneity of other kinds of income and deductions. In addition, the simultaneity of income and tax rates means that econometric results cannot answer policy questions about revenue without simulating to find an equilibrium. Another important econometric problem in most previous studies is the selectivity bias that arises because individuals simultaneously choose the level of capital gains and whether or not to realize a capital gain at all. Furthermore, cross-section studies are unable to account for the dynamics of capital gains responses, i.e., that individuals respond to tax changes with a lag. And time-series studies are subject to aggregation biases and small samples that reduce the precision of statistical estimates.

This paper focusses attention on the latter two problems. First, we attempts to clarify some of the issues related to the choice of data set. Then we present the results of a panel-data study in which the model and methods have been designed to correct several of the most important weaknesses of previous micro-data studies of the effect of taxes on capital gains realizations. To correct for the simultaneity problem in estimation, the model treats, in addition to capital gains, several other components of capital income and deductions as endogenous choice variables. To correct for the simultaneity problem in interpretation of estimated equations, we developed a micro-simulation model to examine the effects of changing the inclusion rate for long-term capital gains income. To correct for selection bias, assumptions of the Tobit model used by Treasury (1985) and Auten and Clotfelter (1982) were relaxed to allow separate criterion and income level equations.[2] In addition, our study incorporates an appropriate exogenous measure of wealth and it is the first to include the effect of state income taxes.

II. Choice of Data Set

A. Determinants of Individual Capital Gains Realizations

We start with a model of how capital gains realizations respond to income tax treatment that is similar to the models used in previous research. As in that literature, we do not model the choice decision of realizing capital gains because theoretical models, such as Stiglitz (1983), do not yield interesting testable hypotheses.[3] We simply follow other authors in positing that realizing capital gains has some economic value as compared to holding assets with capital gains and so, the decision to realize a capital gain depends on whether the value of realizing the gain is at least as great as the cost, which is primarily the capital gains tax.[4]

The value to an individual of realizing a capital gain depends on the individual's stock of unrealized gains. The more capital gains in the individual's portfolio, the more gains are likely to be candidates for realization. Individuals may realize capital gains to finance consumption, and so permanent and transitory income may be important determinants of realizations. And individuals may have different attitudes toward asset trading and risk, and have different discount rates. We assume that these taste parameters depend on observable demographic variables such as marital status, age, and family size.

We also allow for the possibility that individuals engage in tax planning so that their tax rate itself is a choice variable. Most of the earlier studies have made a similar assumption, but with the

[2]The criterion equation is a Probit regression that explains taxpayer decisions of whether or not to realize capital gains. The income level equations explain taxpayer decisions of how much to realize of capital gains and other capital income.

[3]Stiglitz recognizes that his model has limited empirical relevance insofar as it predicts that capital gains tax revenues would be zero under any tax regime.

[4]Kiefer (1988) develops a particularly cogent exposition of capital gains behavior under this simple model.

exception of Cook and O'Hare (1987), their estimation methodology requires that tax planning be limited to the choice of the level of capital gains. Our model assumes that other capital income items, such as dividends and interest, and deductions, such as charitable contributions, may be determined endogenously.[5]

There are two components of capital gains decisions that may respond to tax rates. First, taxpayers may adjust their level of gains in response to different tax rates. Second, some individuals may defer realizations altogether in years when their tax rates are high. For example, in our panel of taxpayers, 35% of capital gains were realized by taxpayers with capital gains in only one year. Our model explicitly accounts for the decision whether or not to realize capital income (or make a charitable contribution) distinct from the level of income or deductions. While Auten and Clotfelter (1982) also accounted for this so-called self-selection, the present study models the decision to realize separately from the level of realization.[6]

B. Why are cross-section and time-series elasticities so different?

Table 1 summarizes the results of previous studies of capital gains realization responses to tax rates. The results are characterized by an elasticity, which represents the approximate change in capital gains realizations in response to a one percent change in tax rates (e.g., from a rate of 20% to 20.2%). As a rough approximation, a capital gains tax cut will increase capital gains revenues if the aggregate elasticity is greater than 1 in absolute value and will reduce capital gains tax revenues if the elasticity is less than 1.[7] Table 1 shows that these elasticity estimates range widely from a low of essentially 0 (Auerbach, 1988) to a high of almost -4.0 (Feldstein, Slemrod, and Yitzhaki (FSY), 1980). Notwithstanding this large variation, there seems to be a clear division

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[5]The possible endogeneity of other income and deductions was recognized by Feldstein, Slemrod, and Yitzhaki (1980). In a footnote, they acknowledge that their tax rate instrument (discussed in section 3 of this paper) would not be exogenous if other income responds to tax rates. They suggested the development of a "more elaborate behavioral model" as a subject for future research.

[6]Auten and Clotfelter estimated a Tobit capital gains equation. While the Tobit model allows for self-selection, it restricts the decision function to be the same as the level equation. The practical implication of this restriction is that individuals who do not realize a gain in a year would realize, at most, only a small gain under the most favorable of tax circumstances. This rules out the possibility that a taxpayer may be waiting to sell a large block of stock or a family business until tax conditions are favorable.

Gillingham, Greenlees, and Zieschang (1989) estimate a logistic version of a model similar to ours.

[7]This is only an approximation because it does not account for how an individual's increased realizations might result in a change in the marginal tax bracket. The effect on capital gains revenues does not directly translate into increased or decreased total tax receipts because the tax change can affect levels of other income and deduction items as discussed below, may affect prices and rates of return in financial markets, and might have macroeconomic feedbacks that would affect total receipts.

between the estimates based on time series and the estimates based on micro data (cross-section or panel data). Although there are exceptions, the time series estimates are generally lower in absolute value than the estimates based on micro data.

The debate about which, if any, set of estimates is relevant for policy purposes is reminiscent of the debate about consumption functions in the 1940s and 1950s. In the case of consumption functions, the conundrum was reconciled by explaining that individuals respond differently to permanent income than to transitory income. Since cross-section income levels include the transitory component that is washed out in the aggregate data, the cross-section consumption function estimates were biased downward. A similar analysis might be useful in explaining the variation in capital gains elasticity estimates.[8]

Suppose that individuals view their marginal tax rate on capital gains as comprising two parts. The first is a statutory component that reflects the average tax rate on capital gains under current law.[9] The second is the individual variation from the average statutory rate. The first component is exogenous to the individual. The second component has both an exogenous component due to uncontrollable temporary changes in taxable income, and an endogenous component that reflects tax planning.

Individuals may respond differently to changes in the statutory marginal tax rate than to changes in the individual-specific component. The statutory component is purely exogenous, which may mean that it is harder for individuals to plan to either take advantage of a low statutory rate or to avoid a high rate. The statutory rate may also be perceived to be more permanent. At present, assume that the statutory component is the same for all individuals in a given year. We will consider later what deviations from this assumption might imply.

The following is a simple linear representation of the model.[10]

$$G_{it} = \alpha TSTAT_t + \beta(T_{it} - TSTAT_t) + \mathbf{X}_{it}\mathbf{\Gamma} + v_{it},$$

[8]The following analysis is largely a formalization of views that have been expressed by other researchers. For example, see Auerbach (1988), Gravelle (1987), Slemrod and Shobe (1989), and U.S. Congressional Budget Office (1988).

[9]To keep things simple, assume that individuals respond instantaneously to tax rate changes. We look at the dynamics of tax rate responses later in this section.

[10]We consider the non-linearity of realization responses later.

where G_{it} is capital gains realizations by individual i in year t, $TSTAT_t$ is the average statutory marginal tax rate on gains in year t, which only varies over time, T_{it} is individual i's marginal tax rate on gains in year t, and $\mathbf{X}_{it}$[11] is a vector of other parameters that affect capital gains.

In this simple model, neither cross-section nor time-series data will permit identification of both α and β. In a time series, the sum of $(T_{it} - TSTAT_t)$ is zero since $TSTAT_t$ is the sum over i of T_{it}. Thus, only α can be identified using time series data. In the special case of this linear model, the time series estimates can yield accurate information about how capital gains realizations and tax revenues respond to changes in tax law.

Using cross-section data, the situation is reversed. β is identifiable whereas α is not. In a cross-section, $TSTAT_t$ is a constant, and its effect is subsumed in the constant term in the X matrix.[12] The coefficient β may be estimated using T_{it} as a regressor in an appropriate simultaneous equation estimation technique (see below).

Panel data are necessary, but not sufficient, to identify both α and β in a single equation. There must be more years in the panel than there are time-varying explanatory variables (such as value of the stock market, interest rates, and $TSTAT_t$). If there are lags or fixed effects in the model, the minimum number of years of data increases accordingly. Finally, as a practical matter, the length of the panel would have to be substantially greater than the minimum to achieve reasonably precise estimates of α because significant shifts in TSTAT are infrequent.

If this simple model were an accurate representation, then we could use cross-section estimates for β and time-series estimates for α. Based on this model, we might conclude that cross-section elasticities are consistently higher than time-series estimates because individuals are more responsive to individual (short-term) variation in marginal tax rates than they are to statutory (long-term) changes.

However, the division between cross-section and time-series components of marginal tax rates is not so clear cut. Individuals face different long-run statutory tax rates because of permanent differences in income and wealth. Thus, cross-section tax elasticities in part reflect a response to the peculiarities of current tax law. Moreover, individuals are affected differently by changes in tax laws, This means that time series estimates based on a single summary variable, such as an average tax rate, are of limited relevance to predict the effects of a tax schedule change that

[11] Boldface notation represents vectors.

[12] Estimates of the intercept term in equation (1) would be biased by an amount equal to (a-b)$TSTAT_t$, but it is unlikely that this would be of any practical significance.

might be significantly different from prior laws.[13] In addition, even the average statutory tax rate varies across individuals because state tax rates on capital gains vary substantially.

There are other drawbacks in time series estimates that arise when the simplifying assumptions made above are relaxed. There are two kinds of potentially serious aggregation bias. First, the relationship between marginal tax rates and realizations is certainly not linear,[14] which means that the aggregate response to changes in tax rates would not be the sum of the individual responses.[15] This implies that (1) time-series estimates of α will be biased estimates of the individual response parameter, and (2) aggregate revenue responses will not in general be the product of aggregate realizations and the average tax rate on capital gains. Second, there may be a sample-selection bias due to individuals' choosing whether or not to realize a capital gain separately from the level of gain.[16] While it is possible to correct for this bias in cross-section or panel data, it is not possible in the time series data, so it is hard to tell if this bias is important or what sign it is likely to have. In addition, there is the obvious problem that time series estimates are necessarily imprecise because there are so few degrees of freedom (typically 30 observations or so).

Cross-section estimates of β will accurately predict responses to tax policy changes only if individuals treat all components of their marginal tax rate in the same way, i.e., $\alpha=\beta$. However, even under this assumption, cross-section estimates may be flawed. There is evidence that individuals do not respond instantaneously to tax rate changes.[17] If individuals respond to tax rate changes with a lag, the absence of lagged tax rate variables would bias elasticity estimates in cross-section data.

Panel data estimates based on a short panel are complements to time series estimates. Using panel data, both sample-selection problems and dynamics may be addressed appropriately.

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[13]This is essentially the Lucas (1976) critique of econometric policy evaluation. Auerbach (1989) also made this point. For example, the Congressional Budget Office estimates that the average marginal tax rate on capital gains was 14% in 1984 and would be nearly the same under the Administration's 1989 budget proposal of a top capital gains rate of 15%. However, individual tax rates varied widely in 1984 whereas they would be nearly uniform (at 15%) under the budget proposal. Furthermore, opportunities for tax planning were much greater in 1984 (before passage of the Tax Reform Act of 1986) than they would be in 1989.

[14]A linear relationship would imply that the change in realizations when tax rates change would be the same for a millionaire as they would be for an individual with no assets. While this might be approximately accurate for the proportional change, it certainly does not apply to the level.

[15]The nature of this bias is explored in Darby, Gillingham, and Greenlees (1988) and U.S. Congressional Budget Office (1989).

[16]See Maddala (1983).

[17]See, for example, Auten and Clotfelter (1982) and Auerbach (1989).

Moreover, the panel data do not suffer from problems of aggregation bias. If tax law changes affect individuals differently, panel estimates based on a panel that spans at least one tax law change will reflect that variation in their elasticity estimates, as well as the individual-specific response to marginal tax rates.

The time series estimates under the most optimistic of assumptions reflect a good estimate of α, the average effect of statutory tax changes. The panel estimates capture how a particular tax law change affects individuals differentially, as well as individuals' responses to other sources of variation in tax rates. It seems reasonable to conjecture that the "correct" elasticity might be between these two sets of estimates.

C. Other advantages of panel data

There are other advantages of panel data over cross-section data sets. First, panel data allow estimation of the dynamics of individual response to capital gains tax changes because lagged data are available. The possible importance of dynamics has been stressed by Auerbach (1988) and Kiefer (1988). Second, panel data provide information to proxy permanent income based on average income over a number of years. Third, the presence of lagged income and deduction items provides useful instruments for two-stage estimation of the simultaneous system of equations and to create exogenous proxies for permanent income and wealth. Fourth, panel data allows for fixed effects such as unobservable taste parameters or components of household wealth.[18]

III. Econometric problems in cross-section studies

Aside from the identification problem discussed in the last section, there is substantial variation in cross-section estimates. Some of the variation in results across previous micro-data studies can be explained by their failure to model the simultaneous nature of the dependency between marginal tax rates, capital gains income, and other forms of income and deductions. In the construction of estimation procedures, most of the studies have accounted in some way for simultaneity of long-term capital gains and marginal tax rates on long-term capital gains. However, none of the micro-data studies has accounted for potential simultaneity of capital gains and other forms of income and deductions.

[18]In our model, we choose to focus on the issues of simultaneity and self-selection, which complicates the estimation of fixed effects models. Slemrod and Shobe (1989) examined the role of fixed effects in a simpler model of capital gains realizations and found them to be statistically insignificant.

Yet more of the variation across micro-data results may be explained by their failure to account correctly for simultaneity when interpreting estimation results. If capital gains income and marginal tax rates are determined simultaneously, then analysis of the effects of changing statutory tax rates on capital gains must account for the fact that actual marginal tax rates would not necessarily change by as much after accounting fully for implied behavioral responses. Ignoring such simultaneity when interpreting the results may cause the impression that capital gains are more sensitive to tax rates than they actually are.

As an additional possible cause of variation in results, all but two studies, Treasury (1985) and Auten and Clotfelter (1982), have failed to correct for sample-selection bias in their parameter estimates. In a sample of primarily upper-income taxpayers, such as the panel-data sample used for this study, less than 50% of the taxpayers realize long-term capital gains income in any one year. Many taxpayers may not realize capital gains simply because they have little wealth. On the other hand, wealthier taxpayers may choose not to realize capital gains either by choosing not to sell appreciated assets or by choosing not to hold their wealth in the form of assets on which capital gains would be realized. For the wealthier group of taxpayers, the decision of whether or not to realize capital gains income may be distinct from the decision of how much capital gains income to realize. Failure to model such a distinction may have led to biased estimation results in previous micro-data studies.

Another issue that arose in the exchange between FSY (1980) and Minarik(1984) was whether weighting was appropriate for estimation. Minarik argued that weighting was essential because the cross-section individual income tax returns in the FSY study were drawn from a stratified sample that oversampled the rich. However, the validity of Minarik's weighting procedure depends on very strong assumptions about unobservable model characteristics.[19] In fact, given that the weights are endogenous (capital gains are an important component of the stratification variable) and the other complexities of the capital gains model, the correct weighting procedure would be very complex.

[19] These assumptions are explored in the case of exogenous sample strata by Duncan and DuMouchel (1983). They derive a test statistic for estimating whether weighting matters, but conclude that weighting is generally not an issue if a model is properly specified.

IV. A Simple Model of Capital Gains and Income Shifting

Some essential features of our model are represented by the following three equation system.[20]

$$G_{it} = a_0 + a_1 T_{it} + a_2 X_{it} + e_{it}, \qquad (1a)$$
$$O_{it} = b_0 + b_1 T_{it} + b_2 Z_{it} + u_{it}, \qquad (1b)$$
$$T_{it} = f(G_{it}, O_{it}, Y_{it}), \qquad (1c)$$

where $i = 1,...,N$, are individuals in the panel and $t = 1,...,S$ are years. G_{it} is realized long-term capital gains, O_{it} represents endogenous components of other taxable income and deductions, T_{it} is the marginal tax rate on ordinary income, X_{it} and Z_{it} represent other exogenous or predetermined factors affecting G_{it} and O_{it}. Y_{it} represents exogenous components of taxable income as well as other factors that determine tax liability.

The marginal tax rate, T, is endogenous so that the parameters in equation (1a) cannot be consistently estimated using least squares. In fact, it can be shown that, under weak assumptions, ordinary least squares estimates of tax elasticities would be biased toward zero (Auten, Burman, and Randolph 1988). Fortunately, the simple model suggests several options for estimating the capital gains equation (1a). First, the equation could be estimated by two-stage least squares, using X_{it}, Z_{it}, and Y_{it} as exogenous variables. This method assumes that the tax rate function, (1c), is linear. Since (1c) is non-linear, and the non-linearities serve to aid identification, we adopt an alternative that is similar to the approach taken by other authors. We construct a tax rate instrument by computing the marginal tax rate after setting the endogenous components of taxable income, G_{it} and O_{it}, equal to zero. This is $f(0,0,Y_{it})$. This variable preserves the information about the non-linear relationship between T_{it} and Y_{it}, while purging T_{it} of its endogenous components.

The tax rate instrument used in previous studies has been either $f(0,O_{it},Y_{it})$ or $f(\hat{G}_{it},O_{it},Y_{it})$, where $\hat{G}_{it}$ is some variant of a reduced form estimate of G_{it}. Such tax rates are only exogenous if both b_1 and the covariance between the equation errors, e_{it} and u_{it}, are zero. While this possibility cannot be ruled out with certainty, it is inappropriate to impose such a restriction a priori. Moreover, if these strong assumptions are not satisfied, estimates of the responsiveness of capital

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[20] For simplicity, O_{it}, X_{it}, Y_{it}, and Z_{it} are treated as scalars here although they are vectors in our estimated model of income determination. It is also assumed for this exposition that the marginal tax rate on long-term capital gains is a fixed fraction of the tax rate on ordinary income (i.e., the ordinary income tax rate multiplied by the included fraction of long-term capital gains). The estimated model does not impose this restriction, which would not hold when there are carried over losses, for example. In addition, we defer consideration of sample selection until later in this section.

gains to tax rates (a_1) as well as other parameters may be biased and inconsistent, and the sign of the bias is indeterminate a priori.[21]

Wealth, as an indicator of accrued capital gains, may be an important determinant of the level of capital gains, but tax return data do not provide a direct measure of wealth. In consequence, previous studies have had to use current endogenous variables such as dividends, interest, and rent as proxies for wealth. For example, FSY (1980), used dividends as a proxy and argued that, while this measure might bias parameter estimates because the relationship between dividends and stock may vary consistently with income, and thus tax rates, the bias would be toward zero. Since FSY were interested in showing that taxes were important in determining the level of capital gains, they argued that this bias would simply mean that the strength of their positive conclusions was, if anything, understated.

However, with both dividends and capital gains endogenously determined, the FSY conclusions about bias are not necessarily correct. If dividends are negatively related to tax rates (and positively related to wealth), the bias from using dividends instead of wealth would likely be negative (i.e., estimated tax elasticities would be overstated).[22]

On the other hand, the FSY hypothesis suggests that there might be a spurious correlation between wealth and income and tax rates that could cause estimates of a_1 to be biased toward zero. The net effect of these factors is ambiguous.

This paper avoids the hazards of using an endogenous proxy for wealth by estimating a reduced form wealth equation using the Office of Tax Analysis (OTA) estate match file, which matched the prior year income tax returns to estate tax returns for estate tax filers in 1982. This procedure yields a functional relationship between observed wealth and predetermined (lagged) income items and demographic variables. We use this estimated variable as a proxy for wealth in our equation estimation. While we have not guaranteed that there is not a problem of errors in variables (the error in the wealth equation may be correlated with the error in the income equation), this wealth measure is purged of the obviously endogenous components in current dividends, etc.

[21]See Auten, Burman, and Randolph (1988) for a discussion of the circumstances under which the bias would be positive or negative.

[22]This is fairly simple to see if we look at the substitution of dividends for wealth as an errors in variables problem (ignoring, for simplicity, the endogeneity of tax rates). The bias in the tax rate coefficient in (1) would be equal to the coefficient on wealth in equation (1) multiplied by the coefficient on tax rates in equation (2) divided by the inclusion rate for capital gains. Since the effect of taxes on dividends is likely to be negative and wealth is positively related to gains the bias is probably negative.

Our model explicitly accounts for the censoring of the observed income and deduction items at zero. The system of equations in (1a) and (1b) is extended to include a criterion function for each of income item. Each criterion function is essentially a Probit model of the decision of whether or not to realize a non-zero amount of the corresponding income. These criterion functions are of the form,

$$G^*_{it} = c_0 + c_1 T_{it} + c_2 X^*_{it} + e^*_{it} \tag{2a}$$

$$O^*_{it} = d_0 + d_1 T^*_{it} + d_2 Z^*_{it} + u^*_{it} \tag{2b}$$

where G^*_{it} and O^*_{it} are unmeasured indices such that G_{it} in (1a) is only observed if $G^*_{it} > 0$ and O_{it} in (1b) is only observed if $O^*_{it} > 0$. X^*_{it} and Z^*_{it} are vectors of exogenous variables that are not necessarily identical to X_{it} and Z_{it}. The error terms are standard normally distributed.

V. Data

The data are from a panel of Federal income tax returns compiled by the U.S. Treasury Department for approximately 12,000 taxpayers for 1979 through 1983. One advantage of the data is the availability of detailed tax data over a time period in which tax laws changed. Another advantage is the availability of the ages and other characteristics of taxpayers in the sample. The sample was stratified to oversample high-income taxpayers, for whom capital gains were more likely to be an important component of income. For estimation, we used a random, though still stratified, subsample of about 5,000 taxpayers, for which four years of data were included for each taxpayer.[23] For simulation we increased the sample size by adding randomly sampled data on about 8,000 taxpayers. Sample weights, used for simulation, reflect the number of taxpayers represented by each of the taxpayers included in the sample. Unlike previous studies which limited their samples to taxpayers with some amount of dividend or rental income or losses, we included all taxpayers in the sample who filed returns in two consecutive years.[24]

Marginal Tax Rates: Marginal tax rates were calculated by increasing the appropriate type of income, e.g., long-term capital gains for the marginal tax rate on long-term capital gains, by the maximum of either $1,000 or the square root of estimated wealth. The total tax liability was then

[23] A subsample was used for estimation due to computer and software limitations. Four years were included so that lagged values of some variables, such as the tax rate, could be used.

[24] Feldstein, Slemrod, and Yitzhaki (1980) and Minarik (1981) limited their samples to taxpayers with at least $3,000 of dividends. Auten and Clotfelter (1982) and Treasury (1985) limited their samples to taxpayers with at least $200 in either dividends or rental income or loss.

divided by the change in income. To calculate the total tax liability, a Federal income tax calculator was adapted for the panel years from a tax calculator developed by the U.S. Treasury, Office of Tax Analysis (Cilke and Wyscarver, 1987). In addition, state tax calculators were developed for all years of the panel.

Wealth: Although the wealth of each taxpayer should be an important determinant of the ability to realize capital gains and other forms of capital income, deductions, and losses, no direct information about taxpayer wealth is reported on income tax returns. Because wealth is important, we developed a proxy variable for wealth by using the U.S. Treasury's Estate-Income Tax Match Study for 1981-82, which included a sample of estate tax returns, matched with corresponding income tax returns for the last full year prior to death. These data were used to compute total wealth, net of life insurance payments, and total stock holdings. The logarithm of total wealth reported on the estate tax returns, net of life insurance payments, was regressed on lagged capital income items, lagged losses, and demographic variables such as age. Because there was a $300,000 exemption for filing estate tax returns, truncated-regression methods were used to estimate parameters of the imputation regressions. The estimated regressions were then used to impute levels of wealth and stock holdings for each taxpayer in the panel sample, conditional on the appropriate lagged values of income and demographic variables.

Permanent Income: The permanent income variable is the predicted value from an estimated regression which had the logarithm of a 5-year average of total positive income as a dependent variable and exogenous income and demographic variables as right-hand-side variables, evaluated at their 1979 levels. Total positive income is the sum of all positive components of income, including capital gains, i.e., gross income before losses. It is a measure of income used by the IRS and several previous studies as a measure of economic income. This measure of permanent income can be interpreted as a measure of expected permanent income.

VI. Equation Specification and Estimation Method

The capital gains level equation and criterion function capture six aspects of individuals' decisions to realize capital gains. There is the decision whether to realize any capital gains at all or to defer realization to another year. This decision is reflected in the criterion function, similar to (2a), discussed in section IV. There is the dynamic response to tax rates. We model this response as a first-order difference equation, where lagged tax rates are assumed to be predetermined. Permanent and transitory income variables are included to reflect the consumption motive for capital gains realizations as well as to control for different attitudes toward risk that may be related to income. Wealth is included as a proxy for accrued capital gains. Lagged business and rental income and lagged rental losses control for previous investments that may be expected to result in capital gains. We also include available demographic variables--marriage dummies, family size, age brackets, and regional dummies--to try to control for different tastes that might affect trading strategies. The age brackets also reflect the benefit of holding capital assets until death, which increases with age[25]. Finally, time dummies reflect the impact of macroeconomic variables that affect individual asset values as well as the constant component of the 1981 tax law change as discussed in section II.

The equations were estimated in two-steps. First, the criterion function parameters were estimated by Probit maximum likelihood. Estimated criterion function parameters were then used to construct Mill's ratios, which were added to the income level equations to correct for sample-selection bias. As the second estimation step, income level equations were estimated by least squares, using only the observations for which non-zero levels of income were realized.

Because the marginal tax-rates are endogenous right-hand-side variables, the two estimation steps were preceded by an instrumental-variables procedure. Before the Probit step, actual marginal tax rates were regressed, using least squares, on all exogenous variables in the criterion function and the tax rate instrument discussed in Section 3. Probit estimates and the resulting Mill's ratios were then obtained using fitted tax rates in place of actual tax rates. Actual tax rates were then regressed, using least squares on the sample of realizers only, on all exogenous variables in the level equation, the tax rate instrument, and the Mill's ratio. Fitted tax values for this subsample were then used in place of actual tax rates in the second step of estimation.[26]

VII. Estimation Results

Estimation results for the capital gains equations appear in Table 2. The first two columns contain parameter estimates for the equations that explain the levels of long- and short-term realizations, respectively. The last two columns are the corresponding parameter estimates for the criterion functions, which explain taxpayers' decisions whether or not to realize capital gains.

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[25]See Holt and Shelton (1962).

[26]Under assumptions of our model, resulting parameter estimates are consistent. Asymptotic standard errors for the parameter estimates were derived by Lee, Maddala, and Trost (1980). Results were obtained by use of the LIMDEP program (see Greene 1988).

For the level equations, the dependent variable is the natural logarithm of the net-positive amount of capital gains before loss carryovers.[27] Each coefficient implies a directional effect of changes in the corresponding right-hand-side (RHS) variable on the dependent variable. For example, wealth was estimated to have a positive effect on the levels of both short- and long-term capital gains.

For the criterion functions, the dependent variables are unobserved indexes that determine whether a taxpayer realizes capital gains income. Capital gains income is realized only if the index is positive. A positive estimate of a criterion-function coefficient implies that an increase in the corresponding RHS variable would increase the likelihood that capital gains are realized.

For two reasons, however, individual coefficients provide only first-order approximations to the full effects of changing RHS variables. First, the current year marginal tax rate is a function of the dependent variable, so that a complete characterization of the effect of any RHS variable must account for all feedback effects on the current year tax variable. Second, complete characterization of the effects of RHS variables must simultaneously consider effects on the level of capital gains and the likelihood of realizing a nonzero amount of capital gains, as implied by the estimated parameters of the criterion functions.

Although complete interpretation of the coefficients requires simulation of the model, as described in Appendix 1, examination of individual coefficients and other parameters is informative. For this purpose, the coefficients can be divided into three groups: tax-rate variables, wealth and income variables, and age and other variables.

The tax variables are -Ln(100-t), where "Ln" is the natural logarithm and t is the appropriate marginal tax rate, either current or lagged, short- or long-term. Because the tax price term is negated, the negative coefficients of the current-year tax variables in the level equations imply that increasing the tax rate decreases capital gains income. Similarly, coefficient estimates for the criterion functions imply that increasing the own tax rate decreases the likelihood of realization. In all four equations, the own lagged tax coefficients are positive, which implies that a higher lagged marginal tax increases both the level of capital gains income and the likelihood that capital gains are realized.

Opposite signs on the coefficients of current and lagged tax-rate variables suggest that taxpayers time capital gains realizations so that they occur in relatively low marginal tax rate years. For example, if the previous year's marginal tax rate was higher, then capital gains would be realized in the current year rather than the previous year. The sums of the current and lagged tax

[27]Equations were also estimated for net negative capital gains and other types of capital income and charitable deductions. Results are reported in Tables 5 and 6.

rate coefficients, i.e., the long-run effects, are negative in all four equations but smaller than the current year tax rate coefficients, i.e., the short-run effects.

As a first-order approximation to the importance of timing relative to the long-run effects of changes in the marginal tax rates, the size of the lagged tax coefficients can be compared to the sum of the current and lagged tax coefficients. For the level equations, timing is about 15% of the tax effect for long-term gains and about 25% of the tax effect for short-term gains. For the criterion functions, timing is about 67% for the long-term gains equation and about 48% for the short-term gains equation. For both types of gains, timing appears to be more important for the likelihood of a sale than it is for the level of a sale. This may reflect the fact that appreciated assets are often indivisible when taxpayers consider which assets to sell, how much, and when. If not all assets are divisible and not all taxpayers have access to a means, such as installment sales, by which they can spread out the sales of indivisible assets over several years, then the relative timing effect would be larger for the sell/don't sell decision than for the how-much-to-sell decision.

The wealth variable coefficients are positive in all four equations, implying that wealthier taxpayers are more likely to realize capital gains and they realize larger amounts of capital gains. Likewise, taxpayers with higher permanent income tend to realize higher levels of short and long-term capital gains.

The transitory income variable seems to be uniformly unimportant. This could be because the important source of transitory variations is reflected in the current and lagged tax rates or because of errors in measurement of transitory and permanent income.

Higher levels of wage and salary income lead to lower levels of short-term capital gains. Because permanent income is held constant, the negative coefficient of wage and salary income implies that higher transitory levels of wages and salaries cause lower levels of short-term capital gains. Taxpayers with higher lagged business losses are more likely to realize each type of capital gains income. Surprisingly, however, the coefficient of the lagged business loss variable is negative and significant in the long-term capital gains equation.

Age has opposite effects on the level and likelihood of realizing capital gains. Older taxpayers are more likely to realize capital gains income but they realize less than younger taxpayers. One possible explanation for such a sign reversal is that wealth is not perfectly measured by other RHS variables. If the distribution of wealth is more highly skewed for young than for older populations of taxpayers, then a smaller fraction of young taxpayers would have capital gains that can be realized, thus causing the younger taxpayers to be less likely to realize capital gains. However, the young taxpayers who realize capital gains may be relatively wealthier than older individuals who realize capital gains.

The estimates of the covariance between the errors in the level equation and criterion function are negative and statistically significant in both the long- and short-term capital gains equations. This suggests that the failure to correct for sample selection may have resulted in important biases in previous research.[28] The negativity of the covariance estimate implies that the Tobit model is inappropriate for modelling selectivity because the covariance is constrained to be 1.0, which is 16 standard deviations away from the estimated covariance of -4.36 in the long-term gains equation. It also suggests that there may be some unobserved variables that are missing from both equations that result in a spurious correlation between the equation errors. For example, individuals with a large amount of capital losses may have small net gains but be especially likely to realize. Another explanation is that some individuals may be "buy and hold" types whereas others trade actively. Those who trade more than expected would then be observed to have lower than average gains.[29]

VIII. Simulation

We developed a simulation method so that the estimated econometric model could be used to examine the effect of changes in the individual income tax code on aggregate capital gains income and Federal tax receipts. A simulation model is necessary for several reasons.

The first and most important reason is simultaneity. The econometric model was constructed so that capital gains income depends upon the marginal tax rate for capital gains. The marginal tax rate also depends upon the level of capital gains income. Estimated coefficients from Table 2 imply that an increase in statutory marginal tax rates on long-term capital gains would also decrease long-term capital gains income. The decrease in capital gains income would, in turn, decrease the tax rate for some taxpayers, etc., until an equilibrium is reached. Simulation is necessary to find the policy effect on the equilibrium solution for each taxpayer.

Second, simulation is necessary so that the individual behavioral effects of tax policy changes are aggregated properly to derive implied effects on aggregate capital gains income and aggregate Federal tax receipts. Behavioral effects must be evaluated on an individual basis and then aggregated because the econometric model implies that each behavioral response depends on the level of the marginal tax from which the evaluation starts, i.e., it is a non-constant tax elasticity model.

[28] We discuss this issue more in Section X.

[29] This type of behavior might be modelled as a fixed effect. See Slemrod and Shobe (1989).

The tax calculator provides the third reason. In the econometric model, capital gains income only depends on the tax code through the marginal tax rate on capital gains. Simulation is the only way to examine the effect of changing the complex tax code in a way that changes the marginal tax rate differently for different taxpayers, depending on their other levels of income items, credits, and deductions. In addition, because state tax codes are included in our calculations, changes in the Federal income tax code would affect marginal tax rates differentially across states.

The fourth reason is statistical. For a standard self-selection model with no endogenous right-hand-side variables, the effects of changing RHS variables can be examined by solving for the expected value of the dependent variable. However, the marginal tax rate in our model is endogenous and it is on the right hand side of the criterion and level equations. The marginal tax rate is also a complicated function of the dependent variable. It is therefore not possible to solve for a closed form for the expected level of capital gains income.

IX. Simulation Experiments

We conducted several simulation experiments. All involved changing the inclusion rate on long-term capital gains, using data and a tax calculator for 1982, when the inclusion rate was 40%. In general, a 5% change (for example, from 40% to 38%) would produce a 5% change in all Federal statutory marginal tax rates.[30] The simulation experiments were therefore designed to examine the effects of changing all statutory marginal tax rates on capital gains income. It should be noted that the results reported below may not accurately reflect Federal revenue responses to statutory tax changes because of the concerns raised in section II.

Results of the simulations appear in Tables 3 and 4. For all but the last several lines of Table 3, the simulations reflect the effect of small changes around the actual inclusion rate for 1982. The long-run elasticity of long-term capital gains with respect to the tax rate is 1.63 whereas the short-run elasticity is not much greater, i.e., 1.98. Part of the long-term elasticity, 1.33, is due to changes in the levels of capital gains income for taxpayers who realize capital gains in the base and

[30]An exception would be if a taxpayer was subject to the alternative minimum tax in the base case. Because the capital gains exclusion was treated as a tax preference and therefore not allowed under the alternative minimum tax in 1982, such taxpayers would experience no change in statutory marginal tax rates as a result of a small change in the inclusion rate. Also, the inclusion rate was changed for Federal taxes only, except for states that automatically used the Federal inclusion rate. To the extent that states varied in their treatment of capital gains taxes, a percentage change in the Federal inclusion rate does not necessarily result in an equal percentage change in the combined marginal tax rates.

comparison simulations.[31] The remainder of the response, .30, is due to taxpayers who switch between realizing and not realizing as a result of a change in the inclusion rate.

Simulation results in Table 3 also demonstrate that actual marginal tax rates do not change as much as statutory marginal tax rates when the inclusion rate is changed. The responsiveness of the actual marginal tax rate is represented by the elasticity of the actual (capital gains weighted average) marginal tax rate on capital gains with respect to a change in the inclusion rate. If there were no state taxes, no alternative minimum tax, and no behavioral feedback effect, then the elasticity would be 1.0. However, the average elasticity is only 0.61 because (aside from the other two factors) there is a behavioral feedback effect for many taxpayers. When the statutory marginal tax rate is decreased, for example, taxpayers respond by increasing their capital gains income, which may push them into higher marginal tax brackets, to which they may respond by not increasing their capital gains income by as much as they, otherwise, would have. The full effect on the actual marginal tax rate would, in such cases, be less than the change in the statutory tax rate.

Table 4 presents another view of the simulation process. Before simulation, capital gains increase from $83.0 billion to $94.3 billion. Of this change, $7.6 billion is due to increased realizations by individuals who realized gains before and after the tax change and the remainder is due to realizations by the additional returns with capital gains.

However, these additional realizations increase individuals' tax rates because of the progressivity of the tax code, especially for those who did not realize capital gains in the baseline case. Simulation adjusts gains (and other income and deductions) until individuals are in equilibrium in the sense that the components of their income solve the estimated equations at the tax rate that is consistent with that their income level. After simulation, most of the induced realizations evaporate when taxpayers figure out that if they realized a big capital gain in response to a lower tax rate, they would be pushed up into a higher tax bracket. The resultant equilibrium shows induced realizations of $2.2 billion, or 2.2% of the total. Increased levels of realizations by individuals with gains in the baseline amount to $5.4 billion.

Under this scenario, tax receipts increase by 0.6% from the baseline because the 9.2% increase in equilibrium realizations more than offsets the 2.7% decrease in average equilibrium tax rates.

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[31]Other capital income equations, discussed in Section 11, such as those for interest income, dividends, and short-run capital gains, were included in the simulation. The effect of changes in the inclusion rate, however, had almost no effect on the other income levels because the other equations contained either the marginal tax rate on ordinary income or that on short-term capital gains. Such tax rates were not effected much by the change in the inclusion rate nor by the resulting changes in levels of long-term capital gains income. The simulated effects on other income items are therefore approximately zero.

We also examined the effect of larger changes in the inclusion rate on long-term capital gains income. The inclusion rate was increased by 50%, i.e., from 40% to 60%. Elasticities averaged over the range of inclusion rates are reported in the last five rows of Table 3. The long-run capital gains elasticity is larger, 1.67, than the elasticity derived for a small change in the inclusion rate for two reasons. First, the average marginal tax rate, and therefore the individual taxpayer elasticities are larger over the range between the 40% and 60% inclusion rates than they are in a neighborhood of the 40% inclusion rate. Second, relative to the simulation of a small change, a large change results in a larger fraction of switching between realizing and not realizing capital gains income. The part due to switchers is .47, which is about 28% of the total response.

Though it was only used to simulate the effects of changing the inclusion rate, the model can be used to simulate the effects of any other tax code change that may affect marginal tax rates.

X. Sensitivity Analysis

A sensitivity analysis was conducted for the long-term capital gains equations to examine the effects of varying the assumptions on which the econometric model was specified and to examine the effect of improvements in the econometric model relative to the models used in previous studies of capital gains taxation. Changes were made to the model, one change at a time. Results for some of these alternative specifications appear in Table 5.[32] The second column was copied from Table 2 for comparison to the results of the sensitivity experiments, which are presented in columns 3 through 9.

The first experiment examined the effects of simultaneity bias. For the experiment, instead of an instrumental variables procedure, the actual tax rate was used. Results reported in column 3 demonstrate that simultaneity bias is an important issue. The tax variable coefficients reverse signs because higher actual capital gains realization levels cause higher marginal tax rates. The resulting bias is large enough to more than offset the negative effect of marginal tax rates on capital gains realizations. Other estimated coefficients are also apparently biased by simultaneity when the actual tax rate is used. For example, the estimated coefficients of the age dummy variables change considerably relative to the coefficient estimates reported in column 2.[33]

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[32]We ran a number of other sensitivity tests that are not reported here. For example, we tested some alternative functional relationships between marginal tax rates and realizations and found preliminary evidence that our results are robust with respect to functional form. We intend to expand on these results in future research.

[33]Technically, the differences from estimates in column 2 are not actually the bias but may be caused by bias. Differences are suggestive of the sign and size of the bias.

Columns 4 and 5 of Table 5 demonstrate the effect of selection bias in estimation of the model parameters. In each case, self-selection was ignored and the capital gains level equation was estimated by an instrumental variables method with no correction for selection bias, i.e., there was no criterion function and there was no Mill's ratio included as a RHS variable. Column 4 used all data, realizers and non-realizers, whereas column 5 used realizers only. In both cases, there is apparently a large bias for the coefficients of the marginal tax rates. The estimated coefficients on wealth increased by an order of magnitude and the coefficients of the age-group dummy variables actually change signs. The results of this experiment suggest that previous capital gains micro-data studies that have ignored selection bias may have overestimated the response of long-term capital gains income to changes in the marginal tax rate.

Results of three other sensitivity experiments are also reported in Table 5. When wealth was omitted, the tax rate coefficients did not change much because other variables, such as age, control for wealth variation. The criterion function and the resulting Mill's-ratio correction variable also control for some wealth variation because the likelihood of realizing capital gains is highly correlated with wealth.

The lagged tax rate variable was omitted as an explanatory variable in the equation summarized in column 7. The estimated coefficient on the current-year marginal tax rate almost exactly equals the sum of the coefficients on current and lagged rates in column 2 and coefficients on other variables are virtually unchanged. This result suggests that the primary value of adjusting for dynamics is that it permits estimation of the short-run response to tax rate changes.

Column 8 suggests that estimates of the response of capital gains realizations to tax rate changes may be biased upward when state taxes are ignored, although the difference in the tax rate coefficient is not statistically significant. The other noticeable difference in column 8 is that the coefficients on regional dummies vary from column 2.

Table 6 reports estimates from weighted and unweighted equations under several different specifications. The effect of weighting on the long-run marginal tax rate does not appear to be significant in our level equation. The unweighted long-run response is -11.6 where as the estimated response in the weighted equation is -10.9. There are significant differences in the wealth and income coefficients, which is not too surprising since the weights are highly correlated with these measures.

In the criterion equation, the weighted profit estimate of the long-run tax rate effect changes sign from -2.7 in the unweighted equation to +0.7 in the weighted equation. The net effect on simulation of weighing in the two equations would be to slightly reduce the simulated change in realizations resulting from a change in tax rate.

The level equation is much less robust when sample-selection bias is ignored. Using all data (realizers and non-realizers), the long-run tax estimate is roughly halved from -13.7 in the unweighted equation to -7.0 in the weighted equation. However, this result is reversed if only realizers are considered. The weighted equation in the case results in an estimated long-run response of -26.8 whereas the unweighted equation estimate is -17.5.

This almost four-fold discrepancy between the weighted estimates in the all-data and realizers-only equations roughly parallels the discrepancies between FSY (1982) and Minarik (1984). Most of the difference between the estimates in these studies appears to be due to their failure to appropriately adjust for sample-selection bias.

XI. Conclusion

This study has attempted to shed light on why empirical capital gains realization equations have produced such widely varying results and to explore the relevance of panel data to resolve some of those questions. Our results suggest that a substantial part of the past variance in realization elasticities may have been due to the simultaneity between marginal tax rates and capital gains realizations and to the failure of previous studies to correctly deal with sample-selection bias. In addition, the failure to deal with these sources of biases has resulted in discrepancies that have been blamed on other causes. For example, much of the discrepancy between FSY and Minarik was probably due to the failure of both authors to adjust for the self-selection in their data sets rather than because of weighting, as Minarik concluded.

We also find that simulation is important for estimating the equilibrium response of individual taxpayers to changes in tax law under a progressive income tax. Previous studies that treated the marginal tax rate as fixed with respect to induced changes in capital gains realizations probably overstated the response of taxpayers to changes in tax rates. On the other hand, the failure to simulate the induced changes in the number of realizers may have resulted in understatements of individual responsiveness.

We found some other factors to be surprisingly unimportant. Income shifting, which was a key subject of this study, does not substantially affect either the estimated parameters in capital gains realization equations or the simulated results of a change in tax regimes. However, because of the limitations of a short panel (for example, because there was no change in the proportional differential between tax rates on capital gains and other income), this negative finding must be viewed as very tentative.

Incorporating dynamics (i.e., lagged tax rates), an exogenous wealth instrument, and state tax rates did not substantially change the estimated long-run response of capital gains realizations to tax rates. However, the lag term did detect a short-term capital gains response that was significantly greater than the long-run response. In addition, the exclusion of wealth seems to bias estimates of the effects of other variables, such as income and age, on capital gains. We also found some evidence that our results are relatively robust with respect to the chosen functional form.

We argue that data from a long panel are essential to fully unravelling the components of capital gains realization responses that are due to Federal policy and the part that is due to individual-specific factors. The panel we used is probably not long enough at present. First, it cannot identify the effects of a differential between capital gains tax rates and other income. Second, it cannot distinguish the aggregate effects of ERTA from other time-series data, such as interest rates and aggregate activity. Since the results are not significantly different in the panel from the results based on separate years, our elasticity estimates probably include the individual-specific response with some part of the aggregate response. More definitive results must await a longer panel.

There are some deficiencies that will not be remedied in any data set, however. First, interpretation of empirical capital gains models will always be subject to debate until there is a firm theoretical foundation for such research. Developing testable theories should be a priority in future research. Second, focussing on individual capital gains realization behavior may ignore some important determinants of the aggregate revenue effects of capital gains tax changes. There should be more research on the effects of capital gains tax policies on rates of return in financial markets and on growth. Without understanding the effects of capital gains tax policies on GNP, interest rates, dividend payouts, and asset values, predictions about revenue consequences must be viewed as tenuous.

Appendix 1. Simulation Method

Using the estimated econometric model, the effect of a change in the inclusion rate on capital gains income was simulated for each taxpayer in the sample for 1982 tax law and income levels. Using sample weights for the number of taxpayers represented by each taxpayer in the sample, the individual simulated effects were then aggregated to derive the effects on aggregate capital gains income and Federal tax receipts.

Simulation consists of four steps: calibration, equilibrium solution for a base case, equilibrium solution for a comparison case, and aggregation. The calibration step generates residuals for the criterion and level equations. Using the structure of the self-selection model and the estimated parameters, regression residuals are drawn in a way that insures that the model, including the residuals, predicts levels of capital gains income that equal the levels actually realized by each taxpayer in the sample for 1982.[34]

Calibration is necessary not only to correctly model the distribution of capital gains income and tax payments, but also to insure realistic results. Because the model implies that the behavioral effect of a change in the capital gains tax depends upon level of the marginal tax rate, calibration is necessary to insure that the model will not systematically over- or underpredict income levels in a manner that would push taxpayers into unrealistically high or low tax brackets. Otherwise, the simulation would predict inaccurate aggregate income and tax-receipt levels.

In the second major step of simulation, iterative numerical methods are used to solve for base case equilibrium levels of capital gains income. An equilibrium is defined as the level of income and marginal tax rates that simultaneously solve the criterion, income level, and marginal tax rate functions. To simulate a steady state with respect to the marginal tax rate in the base case, the equilibrium is solved under the condition that current and lagged marginal tax rates are equal.

The base-case simulation is constructed so that, in the third simulation step, the comparison case can be used to examine either the short- or long-run effect of changes in the tax code. In the comparison case, a new equilibrium solution is found after a change is made in the tax calculator to change the inclusion rate on capital gains income.[35] A short run, or first-year-after-the-change simulation solves for a new equilibrium solution, holding the lagged tax rate fixed at its base-case

[34]Calibration is a monte-carlo method by which sample information is combined with a pseudo-random number generator and estimated parameters in order to provide a distribution of regression errors consistent with the sample.

[35]The effects of other changes to the tax code can also be simulated.

level. A long-run simulation solves for a new steady-state equilibrium, by again equating the current and lagged marginal tax rate.

The last step is aggregation. A simulation is conducted for each taxpayer in the sample. Sample weights are then used to calculate aggregate base and comparison case levels of capital gains income and Federal tax receipts.

Appendix 2. Other Income Regressions

While the focus of our study has been on capital gains, it is useful to examine the results for the other income and deduction equations in Table A1. The wealth and permanent income variables have positive effects on both the decision to realize and the levels of dividends, interest income, and business losses. The effect of transitory income is small in all of the equations and insignificant in most of them.

The age class variables are significant in both the level equations and the criterion functions for dividends and interest. The coefficients increase in size at each age class, holding wealth constant, which implies that older individuals tend to hold more wealth in the form of current-yield assets. Such a pattern does not appear for business losses, however, for which the coefficients are lower for older age brackets.

The coefficients on the current tax rates in the level equations for dividends and interest are both negative, indicating that taxpayers with higher tax rates realize smaller amounts of these types of income. Coefficients on the lagged tax rates, however, are positive and larger than those on current tax rates. These estimates imply that, in the long run, higher tax rates are associated with higher realizations of dividends and interest. The short-run timing effect is negative. Because dividends and interest are expected to be more stable from year to year than capital gains income, and less sensitive to timing decisions, these estimation results are counterintuitive. Furthermore, the coefficients in the criterion functions for dividends and interest all have unexpected signs.

Estimated coefficients for the business loss equations suggest that taxpayers who may face high marginal tax rates invest more in assets that provide ordinary income losses for tax purposes. The combination of such ordinary income losses with long-term capital gains was an essential feature of many tax shelters before the Tax Reform Act of 1986. The lagged tax rate coefficients in the business loss equations are negative, indicating that the long-run effect is smaller than the short-run effect.

In general, the results for the net capital loss equations in Table A2 are less satisfactory than the results for net capital gains in Table 2. The equations poorly explain both the levels of net capital losses and the decisions to realize net capital losses. Relatively few of the non-tax rate coefficients are statistically significant. The tax rate coefficients in the criterion functions, however, have the expected signs. The current year coefficients are positive and the lagged tax-rate coefficients are negative. This suggests that taxpayers with high tax rates have a greater incentive to realize net capital losses and that much of this effect is a short-run timing effect. This result is consistent with previous research in Auten (1982) that suggests that taxpayers control the timing of their losses.

There are a number of factors that may help to explain the unsatisfactory results for the capital loss equations. First, there are far fewer taxpayers that realize net capital losses than realize net capital gains. In a period of inflation, most appreciating assets will yield net nominal capital gains, even though their real value may have declined. Furthermore, there is some evidence suggesting that many investors prefer to continue holding investments with capital losses until they "turn around," even though they would be better off realizing their losses for tax purposes. Second, the mix of assets on which losses are reported is different than that for capital gains. While the largest proportion of losses are from sales of corporate stock, significant shares also come from bonds and commodities (Clark and Paris, 1985). Taxpayers with commodity losses are likely to be wealthier, tax sensitive investors who utilize various devices to minimize taxes and thus have low marginal tax rates. Capital losses on bonds were unusually high during the sample period because long-term interest rates were considerably higher than when the bonds were purchased. The high interest rates reduced the market values of the bonds. In many cases such losses would have been passive losses realized when the bonds matured. Third, the tax rates used in the loss equations are marginal tax rates on long-term or short-term gains. However, due to a $3,000 limitation on the deduction of excess capital losses against ordinary income and the presence of loss-carryover provisions in the tax code, the "true" marginal tax rate on net losses is likely to be complex. Further research on this problem is necessary.

Table 1

Ranges of Point Estimates From Previous Studies: Long-Term Capital Gains Realization Elasticities

Studies	Data Type	Capital Gains Type	Realization Elasticity
Feldstein, Slemrod, and Yitzhaki (1980)	Cross-Section, High-Income Sample, 1973	Corporate Stocks	-3.75
Minarik (1981)	Cross-Section High-Income Sample, 1973	Corporate Stocks	Range from -.44 to -.79
Auten and Clotfelter (1982)	Panel Data, Middle-Income Sample, 1967 to 1973	All Capital Assets	Short-Run Range: -.91 to -3.46, Long-Run Range: -.36 to -1.45
U.S. Treasury (1985)	Panel Data, 1971 to 1975	All Capital Assets	Long-Run Range: -1.16 to -2.20
		Corporate Stocks	Long Run: -2.07
U.S. Treasury (1985)	Time Series, 1954-1985, All Taxpayers	All Capital Assets	Short Run: -1.3 Long Run: -0.8
Lindsey (1987)	Pooled Cross-Section and Time Series, 1965-1982	All Capital Assets	*Short Run: -2.14 *Long Run: -1.37
Darby, Gillingham, and Greenlees (1988)	Time Series, 1954 to 1985, All Taxpayers	All Capital Assets	*Long-Run Range: -.62 to -1.51
Congressional Budget Office (1988)	Time Series, 1954 to 1985, All Taxpayers	All Capital Assets	*Range from -.79 to -.99
Auerbach (1988)	Time Series, 1954 to 1986, All Taxpayers	All Capital Assets	*Long-Run Range: -.06 to -1.08

* Derived at 25.4% average tax.

Table 2
Capital Gains Equations

Right-Hand Variable	Level Equations Long-Term	Level Equations Short-Term	Criterion Functions Long-Term	Criterion Functions Short-Term
Intercept	-43.43	-2.87	-25.19	-10.51
	(8.21)	(0.68)	(13.61)	(16.12)
Marginal Tax Rate Long-Term Gains	-13.17	...	-4.50	...
	(9.42)		(9.15)	
Marginal Tax Rate Lagged, Long-Term Gains	1.58	...	1.81	...
	(4.18)		(10.55)	
Marginal Tax Rate Short-Term Gains	...	-3.12	...	-0.65
		(4.87)		(3.38)
Marginal Tax Rate Lagged, Short-Term Gains	...	0.62	...	0.21
		(2.24)		(2.21)
Log of Wealth	0.49	0.14	0.75	0.46
	(3.98)	(0.61)	(27.40)	(19.02)
Log, Permanent Income	0.15	0.27	0.13	0.06
	(4.03)	(4.53)	(7.95)	(4.04)
Log, Transitory Income	5.00E-03	7.76E-03	2.10E-03	2.60E-03
	(0.86)	(0.83)	(0.95)	(1.05)
Log, Lagged Business Income	-0.07	...	0.03	...
	(7.95)		(12.64)	
Log of Wages	...	-0.03	...	-0.01
		(2.18)		(5.02)
Log, Lagged Rent Losses	7.20E-04	...	8.20E-03	...
	(0.08)		(2.42)	
Log, Lagged Business Losses	-0.06	-0.02	0.04	0.04
	(4.25)	(0.58)	(13.29)	(14.43)
Marriage Dummy	0.19	0.41	0.12	0.04
	(1.88)	(2.56)	(3.71)	(0.91)
Family Size	-0.05	-0.04	-0.01	0.00
	(2.02)	(0.98)	(1.07)	(0.35)
Age 30-39	-0.76	0.08	0.48	0.41
	(3.35)	(0.18)	(8.47)	(5.52)
Age 40-49	-1.46	-0.60	0.69	0.38
	(5.89)	(1.42)	(12.28)	(5.12)
Age 50-59	-1.89	-0.84	0.81	0.31
	(7.26)	(2.15)	(15.00)	(4.33)

(continued)

Note: T-ratios are in parentheses

Table 2
Capital Gains Equations

Right-Hand Variable	Level Equations Long-Term	Short-Term	Criterion Functions Long-Term	Short-Term
(continued)				
Age 60-69	-1.76	-0.91	0.77	0.28
	(6.69)	(2.36)	(13.93)	(3.72)
Age 70 and Over	-1.71	-1.05	0.95	0.23
	(6.05)	(2.74)	(16.48)	(2.93)
South Dummy	0.11	0.24	0.03	-0.08
	(1.41)	2.05	(1.03)	(2.72)
West Dummy	0.71	0.12	-0.01	-0.13
	(5.53)	(0.65)	(0.32)	(2.71)
Northeast Dummy	0.52	0.41	-0.02	0.12
	(5.90)	(3.18)	(0.52)	(3.87)
1981 Dummy	-0.93	0.23	0.10	-0.17
	(6.34)	(1.49)	(2.79)	(5.07)
1982 Dummy	-1.57	-0.87	0.06	-0.18
	(11.13)	(5.43)	(1.83)	(4.24)
1983 Dummy	-1.32	-0.87	0.16	-0.02
	(9.64)	(5.19)	(4.93)	(0.46)
Standard Deduction	...	...	-0.21	-0.35
			(6.65)	(9.15)
Error Covariance	-4.36	-2.22	...	...
	(12.62)	(3.33)		
Sigma	4.26	3.21	...	...
Observations:	9435	3235	19000	19000

Note: T-ratios are in parentheses

Table 3

Simulation Results

Experiment: Change the Inclusion Rate on Long-Term Capital Gains Income (1982)

Experiment: Small changes in the inclusion rate	
Long-term gains:	
Short-run realization elasticity	-1.98
Long-run realization elasticity	-1.63
Part due to non-switchers	-1.33
Part due to switchers	-0.30
Responsiveness of actual marginal tax	0.61
Federal individual income tax receipts (1982):	
Short-run elasticity	-0.13
Long-run elasticity	-0.11
Experiment: Raise the inclusion rate to 60%	
Long-run realization elasticity	-1.67
Part due to non-switchers	-1.20
Part due to switchers	-0.47
Responsiveness of actual marginal tax	0.65
Long-run individual income tax receipt elasticity	-0.07

Table 4

Simulation Results

5% Decrease in the Inclusion Rate on Long-Term Capital Gains (1982)

	Changes before iteration			Changes in equilibrium		
	Baseline (1)	Comparison (2)	% Change (3)	Baseline (4)	Comparison (5)	% Change (6)
Average marginal tax rate, long-term capital gains	17.8	16.9	-5.0%	17.8	17.3	-2.7%
Total net long-term gains ($ billions)	83.0	94.3	13.6%	83.0	90.6	9.2%
Number of returns with net gains or losses (thousands)	6,447	6,595	2.3%	6,447	6,473	0.4%
Net long-term gains on returns with gains in baseline and comparison ($ billions)	77.2	84.8	9.9%	82.8	88.4	6.8%
Percent of total net gains	93.0%	89.9%	...	99.8%	97.6%	...
Net long-term gains on returns with gains in baseline only ($ billions)	5.8	...	...	0.2	...	...
Percent of total net gains	7.0%	...	...	0.2%	...	...
Net long-term gains on returns with gains in comparison only ($ billions)	...	9.5	...	...	2.2	...
Percent of total net gains	...	10.1%	...	...	2.4%	...
Federal individual income tax receipts ($ billions)	277.6	280.4	1.0%	277.6	279.3	0.6%

Table 5
Sensitivity Analysis, Long-Term Capital Gains Level Equation

Right-Hand Variable	From Table 1 (2)	Actual Tax Rate (3)	Intst Vars All Data (4)	Intst Vars Realizers (5)	Wealth Omitted (6)	Lags Omitted (7)	No State Tax Rates (8)
Intercept	-43.43	-2.11	-113.69	-100.73	-27.89	-42.94	-49.50
	(8.21)	(1.34)	(15.91)	(11.32)	(5.61)	(8.26)	(8.20)
Marginal Tax Rate Long-Term Gains	-13.17	1.26	-22.40	-22.96	-11.01	-11.59	-14.51
	(9.42)	(4.07)	(11.67)	(10.17)	(7.60)	(10.39)	(9.01)
Marginal Tax Rate Lagged, Long-Term Gains	1.58	-0.82	8.72	5.45	0.93	...	1.52
	(4.18)	(4.46)	(12.82)	(8.91)	(2.36)		(3.85)
Sum of Lagged and Current Tax-Rate Coefficients	-11.59	0.44	-13.68	-17.51	-10.08	-11.59	-12.99
Log of Wealth	0.49	0.98	3.22	1.92	...	0.47	0.47
	(3.98)	(10.66)	(32.31)	(19.24)		(3.80)	(3.73)
Log, Permanent Income	0.15	0.03	0.78	0.48	0.08	0.15	0.16
	(4.03)	(1.16)	(12.87)	(8.56)	(1.76)	(3.91)	(3.99)
Log, Transitory Income	5.00E-03	-5.60E-03	2.10E-03	3.99E-03	4.80E-03	3.40E-03	5.70E-03
	(0.86)	(1.12)	(0.25)	(0.52)	(0.67)	(0.54)	(0.87)
Log, Lagged Business Income	-0.07	-0.01	0.09	-0.01	-0.08	-0.07	-0.07
	(7.95)	(1.36)	(9.81)	(0.61)	(5.94)	(8.02)	(7.70)
Log, Lagged Rent Losses	7.20E-04	1.00E-02	3.60E-02	2.10E-02	-1.90E-03	9.87E-05	1.20E-03
	(0.08)	(1.44)	(2.70)	(1.99)	(0.19)	(0.01)	(0.13)
Log, Lagged Business Losses	-0.06	0.08	0.16	0.02	-0.08	-0.07	-0.06
	(4.25)	(7.53)	(13.93)	(1.86)	(3.04)	(4.46)	(4.02)
Marriage Dummy	0.19	0.17	0.63	0.49	0.23	0.18	0.19
	(1.88)	(2.03)	(4.89)	(3.82)	(2.10)	(1.77)	(1.82)
Family Size	-0.05	-0.03	-0.06	-0.70	-0.05	-0.05	-0.06
	(2.02)	(1.21)	(1.70)	(2.09)	(1.88)	(1.95)	(2.12)
Age 30-39	-0.76	0.29	1.00	1.02	-0.91	-0.82	-0.78
	(3.35)	(1.26)	(5.27)	(3.22)	(3.69)	(3.56)	(3.37)

(continued)

Note: T-ratios are in parentheses

Table 5
Sensitivity Analysis, Long-Term Capital Gains Level Equation

Right-Hand Variable	From Table 1 (2)	Actual Tax Rate (3)	Intst Vars All Data (4)	Intst Vars Realizers (5)	Wealth Omitted (6)	Lags Omitted (7)	No State Tax Rates (8)
(continued)							
Age 40-49	-1.46	-0.09	1.45	0.95	-1.70	-1.55	-1.48
	(5.89)	(0.36)	(7.61)	(3.06)	(5.79)	(6.11)	(5.79)
Age 50-59	-1.89	-0.29	1.78	0.83	-2.19	-1.97	-1.91
	(7.26)	(1.11)	(9.73)	(2.73)	(6.44)	(7.41)	(7.08)
Age 60-69	-1.76	-0.16	1.73	0.95	-2.04	-1.84	-1.78
	(6.69)	(0.61)	(9.09)	(3.12)	(5.65)	(6.87)	(6.54)
Age 70 and Over	-1.71	0.04	2.51	1.42	-2.08	-1.81	-1.76
	(6.05)	(0.13)	(12.49)	(4.54)	(4.94)	(6.27)	(5.98)
South Dummy	0.11	0.41	0.19	0.19	0.10	0.10	0.24
	(1.41)	(6.60)	(1.93)	(2.03)	(1.15)	(1.29)	(3.10)
West Dummy	0.71	0.33	0.16	0.82	0.68	0.70	0.32
	(5.53)	(3.28)	(0.99)	(5.19)	(4.89)	(5.46)	(2.51)
Northeast Dummy	0.52	0.36	0.13	0.56	0.55	0.52	0.41
	(5.90)	(5.03)	(1.17)	(5.17)	(5.72)	(5.88)	(4.67)
1981 Dummy	-0.93	0.42	0.23	-0.95	-0.94	-0.88	-1.02
	(6.34)	(4.63)	(1.72)	(5.32)	(5.18)	(6.26)	(6.31)
1982 Dummy	-1.57	-0.30	-0.21	-1.55	-1.51	-1.60	-1.67
	(11.13)	(3.35)	(1.53)	(9.06)	(8.48)	(11.26)	(10.69)
1983 Dummy	-1.32	-0.13	0.32	-1.08	-1.33	-1.37	-1.45
	(9.64)	(1.43)	(2.52)	(7.05)	(7.51)	(9.77)	(9.43)
Error Covariance	-4.36	-1.08	...	...	-5.12	-4.47	-4.43
	(12.62)	(3.78)			(9.08)	(12.51)	(11.90)
Sigma	4.26	2.54	5.50	3.67	4.71	4.27	4.31
Observations:	9435	9435	19000	9435	9435	9435	9432

Note: T-ratios are in parentheses

Table 6
Effect of Sample Weights on Long-Term Capital Gains Estimates

	Level Equation		Criterion Function		Intst Vars, All Data		Intst Vars, Realizers	
Right-Hand Variable	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
Intercept	-43.43 (8.21)	-33.42 (3.29)	-25.19 (13.61)	-20.20 (10.54)	-113.69 (15.91)	-80.72 (12.99)	-100.73 (11.32)	-141.69 (18.35)
Marginal Tax Rate Long-Term Gains	-13.17 (9.42)	-14.91 (6.30)	-4.50 (9.15)	-0.45 (1.07)	-22.40 (11.67)	-14.78 (8.26)	-22.96 (10.17)	-37.17 (18.52)
Marginal Tax Rate Lagged, Long-Term Gains	1.58 (4.18)	4.00 (4.20)	1.81 (10.55)	1.18 (4.79)	8.72 (12.82)	7.82 (11.12)	5.45 (8.91)	10.32 (17.81)
Log of Wealth	0.49 (3.98)	-0.60 (1.37)	0.75 (27.40)	1.53 (25.62)	3.22 (32.31)	2.99 (34.70)	1.92 (19.24)	1.54 (16.38)
Log, Permanent Income	0.15 (4.03)	0.32 (3.38)	0.13 (7.95)	0.07 (2.71)	0.78 (12.87)	0.85 (18.52)	0.48 (8.56)	0.83 (20.00)
Log, Transitory Income	5.00E-03 (0.86)	4.80E-02 (2.92)	2.10E-03 (0.95)	-7.13E-03 (0.20)	2.10E-03 (0.25)	-3.60E-03 (0.71)	3.99E-03 (0.52)	1.98E-02 (3.83)
Log, Lagged Business Income	-0.07 (7.95)	-0.04 (2.10)	0.03 (12.64)	0.04 (10.54)	0.09 (9.81)	0.08 (14.35)	-0.01 (0.61)	0.01 (1.38)
Log, Lagged Rent Losses	7.20E-04 (0.08)	3.80E-02 (1.28)	8.20E-03 (2.42)	-1.70E-03 (0.21)	3.60E-02 (2.70)	-2.10E-02 (1.57)	2.10E-02 (1.99)	4.20E-02 (4.09)
Log, Lagged Business Losses	-0.06 (4.25)	0.02 (1.01)	0.04 (13.29)	0.03 (5.10)	0.16 (13.93)	0.08 (8.03)	0.02 (1.86)	-0.04 (4.30)
Marriage Dummy	0.19 (1.88)	0.63 (3.38)	0.12 (3.71)	-0.09 (2.31)	0.63 (4.89)	-0.07 (1.20)	0.49 (3.82)	0.45 (7.35)
Family Size	-0.05 (2.02)	-0.06 (1.01)	-0.01 (1.07)	-0.01 (0.51)	-0.06 (1.70)	0.01 (0.47)	-0.70 (2.09)	-0.05 (2.26)
Age 30-39	-0.76 (3.35)	-0.47 (1.55)	0.48 (8.47)	0.59 (11.20)	1.00 (5.27)	0.42 (6.72)	1.02 (3.22)	0.58 (5.99)
Age 40-49	-1.46 (5.89)	-0.30 (0.91)	0.69 (12.28)	0.74 (13.27)	1.45 (7.61)	0.50 (7.25)	0.95 (3.06)	1.07 (10.61)

(continued)

Note: T-ratios are in parentheses

Table 6
Effect of Sample Weights on Long-Term Capital Gains Estimates

Right-Hand Variable	Level Equation Unweighted	Level Equation Weighted	Criterion Function Unweighted	Criterion Function Weighted	Intst Vars, All Data Unweighted	Intst Vars, All Data Weighted	Intst Vars, Realizers Unweighted	Intst Vars, Realizers Weighted
(continued)								
Age 50-59	-1.89	-0.35	0.81	0.82	1.78	0.74	0.83	1.16
	(7.26)	(1.01)	(15.00)	(15.29)	(9.73)	(10.90)	(2.73)	(12.53)
Age 60-69	-1.76	-0.32	0.77	0.90	1.73	0.93	0.95	1.29
	(6.69)	(0.91)	(13.93)	(16.84)	(9.09)	(13.32)	(3.12)	(14.32)
Age 70 and Over	-1.71	-0.72	0.95	1.12	2.51	1.58	1.42	1.45
	(6.05)	(1.91)	(16.48)	(21.27)	(12.49)	(20.63)	(4.54)	(15.23)
South Dummy	0.11	0.51	0.03	-0.05	0.19	-2.20E-04	0.19	0.26
	(1.41)	(3.84)	(1.03)	(1.68)	(1.93)	(0.01)	(2.03)	(5.17)
West Dummy	0.71	0.82	-0.01	-0.30	0.16	-0.37	0.82	1.17
	(5.53)	(2.92)	(0.32)	(4.99)	(0.99)	(4.83)	(5.19)	(11.21)
Northeast Dummy	0.52	0.58	-0.02	-0.20	0.13	-0.32	0.56	0.62
	(5.90)	(3.02)	(0.52)	(5.07)	(1.17)	(5.94)	(5.17)	(9.61)
1981 Dummy	-0.93	-0.21	0.10	0.16	0.23	-0.28	-0.95	-2.29
	(6.34)	(1.19)	(2.79)	(4.02)	(1.72)	(3.41)	(5.32)	(16.78)
1982 Dummy	-1.57	-1.07	0.06	0.40	-0.21	-0.04	-1.55	-2.14
	(11.13)	(4.75)	(1.83)	(10.14)	(1.53)	(0.49)	(9.06)	(17.29)
1983 Dummy	-1.32	-0.49	0.16	0.17	0.32	-0.63	-1.08	-1.69
	(9.64)	(2.56)	(4.93)	(4.15)	(2.52)	(0.91)	(7.05)	(15.56)
Standard Deduction	...	...	-0.21	-0.49	...	...	...	...
			(6.65)	(12.63)				
Error Covariance	-4.36	-1.91	...	...	...	...	...	...
	(12.62)	(4.75)						
Sigma	4.26	2.83	...	...	5.50	2.44	3.67	1.88
Observations:	9435	9436	19000	19000	19000	19000	9435	9436

Note: T-ratios are in parentheses

Table A.1
Other Income, Loss, and Deduction Equations

Right-Hand Variable	Level Equations: Dividends	Interest	Losses	Charity	Criterion Functions: Dividends	Interest	Losses	Charity
Intercept	-21.99	-10.84	-14.07	-11.77	-9.43	-5.43	-6.82	3.44
	(26.47)	(13.33)	(10.62)	(15.21)	(15.88)	(5.65)	(10.76)	(5.32)
Marginal Tax Rate Ordinary Income	-1.00	-0.37	3.92	-0.77	1.13	1.55	0.89	1.31
	(3.52)	(1.36)	(7.40)	(3.10)	(5.39)	(5.40)	(5.17)	(7.00)
Marginal Tax Rate Lagged Ordinary Income	1.43	0.49	-2.17	1.11	-0.05	-0.54	-0.18	0.90
	(8.73)	(3.08)	(8.18)	(8.38)	(0.35)	(2.85)	(1.60)	(7.51)
Log of Stocks	12.64	...	...	...	5.35	...	...	...
	(64.15)				(53.01)			
Log of Wealth	...	1.31	1.38	1.21	...	0.70	0.53	-0.01
		(33.68)	(19.70)	(35.15)		(16.73)	(17.79)	(0.35)
Log, Permanent Income	0.09	0.11	0.19	0.28	0.05	0.04	0.07	0.51
	(4.15)	(5.49)	(5.24)	(9.51)	(2.77)	(1.70)	(3.80)	(31.41)
Log, Transitory Income	6.70E-03	-1.20E-03	9.90E-03	6.10E-03	-1.40E-02	-1.10E-02	2.10E-04	-2.10E-01
	(1.74)	(0.31)	(1.60)	(1.77)	(4.20)	(2.79)	(0.07)	(6.84)
Log of Wages	-0.02	-0.05	...	...	-0.02	-0.02	...	
	(3.89)	(11.12)			(5.49)	(4.66)		
Log of Lagged Wages	...	...	0.01	-0.04	...	...	3.10E-03	2.50E-03
			(0.92)	(10.60)			(1.14)	(0.87)
Log, Lagged Business Losses	0.04	0.05	0.68	0.05	0.06	0.06	0.19	-4.40E-03
	(8.36)	(11.33)	(21.45)	(14.53)	(18.73)	(13.40)	(66.02)	(1.36)
Marriage Dummy	-0.24	-0.11	-0.06	0.11	0.17	0.44	0.08	0.40
	(4.03)	(1.96)	(0.59)	(2.05)	(4.17)	(10.06)	(2.01)	(10.67)
Family Size	-0.03	-0.02	0.13	0.10	-0.02	-0.07	0.04	0.01
	(2.06)	(1.62)	(5.17)	(7.47)	(2.10)	(5.29)	(3.92)	(1.03)
Age 30-39	0.05	0.06	1.15	0.19	0.51	0.46	0.34	0.29
	(0.35)	(0.60)	(5.57)	(1.85)	(9.70)	(9.14)	(5.19)	(5.36)
Age 40-49	0.39	0.36	0.94	0.33	0.85	0.64	0.37	0.10
	(2.59)	(3.59)	(4.57)	(3.27)	(15.31)	(11.69)	(5.58)	(1.86)
Age 50-59	0.68	0.53	0.77	0.47	1.20	0.72	0.29	-0.06
	(4.56)	(5.48)	(3.89)	(4.66)	(21.29)	(12.96)	(4.46)	(1.11)
Age 60-69	1.05	0.75	0.12	0.67	1.77	0.90	0.09	-0.04
	(6.83)	(7.47)	(0.61)	(6.52)	(26.79)	(13.92)	(1.27)	(0.68)
Age 70 and Over	1.76	1.06	-0.63	0.99	2.58	1.17	-0.24	0.15
	(11.34)	(9.94)	(3.12)	(9.13)	(28.22)	(13.63)	(3.22)	(2.43)

(continued)

Note: T-ratios are in parentheses

Table A.1
Other Income, Loss, and Deduction Equations

Right-Hand Variable	Level Equations: Dividends	Interest	Losses	Charity	Criterion Functions: Dividends	Interest	Losses	Charity
(continued) South Dummy	-0.07 (1.63)	0.41 (10.14)	0.17 (2.52)	0.06 (1.51)	-0.01 (0.21)	-0.14 (4.07)	-0.03 (0.86)	-0.22 (7.46)
West Dummy	-0.16 (2.20)	0.31 (4.53)	0.38 (3.40)	-0.32 (5.39)	-0.13 (2.59)	-0.06 (1.02)	0.06 (1.20)	-0.03 (0.59)
Northeast Dummy	0.19 (3.99)	-0.12 (2.76)	-0.06 (0.75)	0.08 (1.91)	0.13 (3.45)	0.15 (3.19)	-0.06 (1.72)	1.00E-03 (0.03)
1981 Dummy	-0.06 (1.07)	0.35 (7.54)	0.28 (3.34)	0.04 (0.83)	0.08 (2.18)	0.09 (2.03)	0.08 (2.40)	-0.04 (1.16)
1982 Dummy	-0.39 (4.71)	0.11 (1.63)	0.39 (3.04)	-0.38 (5.34)	0.12 (2.26)	0.23 (3.68)	0.10 (2.08)	0.22 (4.51)
1983 Dummy	-0.41 (5.92)	0.06 (1.04)	0.29 (2.53)	-0.16 (2.57)	0.11 (2.38)	0.30 (5.69)	0.22 (5.34)	0.32 (7.76)
Standard Deduction	...	...	...	...	-0.21 (5.43)	-0.48 (11.24)	-0.10 (2.47)	...
Error Covariance	0.58 (6.51)	-3.14 (18.80)	4.18 (15.03)	-0.23 (1.89)	...	...	...	...
Sigma	1.95	2.32	3.36	1.71	...	...	...	...
Observations:	12104	16585	9103	13289	19000	19000	19000	19000

Note: T-ratios are in parentheses

Table A.2

Capital Loss Equations

Right-Hand Variable	Level Equations Long-Term	Level Equations Short-Term	Criterion Functions Long-Term	Criterion Functions Short-Term
Intercept	-49.17 (1.70)	-42.26 (2.38)	5.05 (2.16)	-9.35 (14.42)
Marginal Tax Rate Long-Term Gains	-25.80 (1.32)	...	2.82 (4.50)	...
Marginal Tax Rate Lagged, Long-Term Gains	8.09 (1.15)	...	-1.12 (5.25)	...
Marginal Tax Rate Short-Term Gains	...	-21.40 (1.76)	...	0.30 (1.58)
Marginal Tax Rate Lagged, Short-Term Gains	...	4.11 (1.41)	...	-0.52 (5.63)
Log of Wealth	-0.83 (0.69)	-0.77 (0.73)	0.07 (2.32)	0.45 (18.28)
Log, Permanent Income	0.13 (0.64)	-0.35 (1.18)	-0.02 (0.76)	0.06 (3.85)
Log, Transitory Income	-6.50E-03 (0.21)	1.59E-02 (0.98)	-4.10E-03 (1.41)	-1.40E-03 (0.55)
Log, Lagged Business Income	0.01 (0.31)	...	-2.60E-03 (0.88)	...
Log of Wages	...	0.04 (0.98)	...	-3.10E-03 (1.17)
Log, Lagged Rent Losses	9.40E-03 (0.20)	...	-4.18E-03 (0.98)	...
Log, Lagged Business Losses	-0.03 (0.32)	-0.14 (1.24)	0.02 (5.11)	0.03 (10.94)
Marriage Dummy	0.32 (0.41)	-0.64 (1.02)	-0.11 (2.32)	0.14 (3.62)
Family Size	0.05 (0.38)	-0.03 (0.41)	0.02 (1.87)	-0.01 (0.52)
Age 30-39	-1.45 (0.65)	-1.17 (0.94)	0.29 (3.13)	0.26 (3.59)
Age 40-49	-1.59 (0.65)	-1.04 (0.87)	0.42 (4.59)	0.33 (4.62)
Age 50-59	-1.63 (0.69)	-0.96 (0.97)	0.40 (4.45)	0.29 (4.20)

(continued)

Note: T-ratios are in parentheses

REFERENCES

Auerbach, A.J. (1988), "Capital Gains Taxation in the United States: Realizations, Revenue and Rhetoric," Brookings Papers on Economic Activity.

Auten, G.E. (1982), "Estimation of the Effects of Capital Gains Taxes on Realization of Capital Gains," final report to the U.S. Treasury Department, Office of Tax Analysis.

Auten, G.E., L.E. Burman, and W.C. Randolph (1988), "A Panel Data Model of Capital Gains and Taxable Income," unpublished manuscript, U.S. Treasury.

Auten, G.E. and C. Clotfelter (1982), "Permanent Versus Transitory Tax Effects and the Realization of Capital Gains," Quarterly Journal of Economics.

Cilke, J.M. and R.A. Wyscarver (1987), "The Treasury Individual Tax Simulation Model," Compendium of Tax Research, Office of Tax Analysis, Department of the Treasury, Washington, D.C.

Clark, B. and D. Paris (1985), "Sales of Capital Assets, 1981 and 1982," Statistics of Income Bulletin, Vol. 5, No. 3, Winter 1985-86.

Cook, E.W., and J.F. O'Hare (1987), "Issues Relating to the Taxation of Capital Gains," National Tax Journal, Vol. XL, No. 3.

Darby, M.R., R. Gillingham, and J.S. Greenlees (1988), "The Direct Revenue Effects of Capital Gains Taxation: A Reconsideration of the Time-Series Evidence," Treasury Bulletin, Spring Issue.

Duncan, G. and W. DuMouchel (1983), "Using Sample Survey Weights in Multiple Regression Analyses of Stratified Samples," Journal of the American Statistical Association 78, No. 383.

Feldstein, M. and S. Yitzhaki (1978), "The Effects of the Capital Gains Tax on the Selling and Switching of Common Stock," Journal of Public Economics 9, No. 1.

Feldstein, M., J. Slemrod, and S. Yitzhaki (1980), "The Effects of Taxation on the Selling of Corporate Stock and the Realization of Capital Gains," Quarterly Journal of Economics 94, No. 4.

Gillingham, R., J.S. Greenlees, and K.D. Zieschang (1989), "New Estimates of Capital Gains Realization Behavior: Evidence from Pooled Cross-Section Data," OTA working paper (forthcoming).

Gravelle, J. (1987), "A Proposal for Raising Revenue by Reducing Capital Gains Taxes," CRS Report 87-562E.

Greene, W.H. (1988), "LIMDEP Reference Manual," (unpublished manuscript).

Holt, C. and J. Shelton (1962), "The Lock-in Effect of the Capital Gains Tax," National Tax Journal, Vol. XV, No. 4.

Kiefer, D. (1988), "The Capital Gains Response to a Tax Rate Change: Is it Overestimated?" Congressional Research Service Report.

Lee, L.F., G.S. Maddala, and R.P. Trost (1980), "Asymptotic Covariance Matrices of Two-Stage Probit and Two-Stage Tobit Methods for Simultaneous Models with Selectivity," Econometrica 48.

Lindsey, L.B. (1987), "Capital Gains Rates, Realizations, and Revenues," in Martin Feldstein, ed., The Effects of Taxation on Capital Accumulation, Chicago: The University of Chicago Press.

Lucas, R.E., Jr. (1976),"Econometric Policy Evaluation: A Critique," in The Phillips Curve and Labor Markets, in K. Brunner and A.H. Meltzer, eds., Amsterdam: North-Holland.

Maddala, G.S. (1983), Limited-Dependent and Qualitative Variables in Econometrics, Cambridge: Cambridge University Press.

Minarik, J.J. (1984), "The Effects of Taxation on the Realization of Capital Gains: Comment," Quarterly Journal of Economics, February.

__________ (1981), "Capital Gains," in H.J. Aaron and J.H. Pechman, eds., How Taxes Affect Economic Behavior, Washington D.C.: The Brookings Institution.

Slemrod, J. and Shobe, W. (1989), "The Tax Elasticity of Capital Gains Realizations: Evidence from a Panel of Taxpayers," (unpublished manuscript).

Stiglitz, J.E. (1983), "Some Aspects of the Taxation of Capital Gains," Journal of Public Economics.

U.S. Congressional Budget Office (1988), "How Capital Gains Tax Rates Affect Revenues: The Historical Evidence."

__________ (1989), "Simulating the Revenue Effects of Changes in the Taxation of Capital Gains," Congressional Budget Office Staff Working Papers.

U.S. Department of the Treasury (1985), "Report to Congress on the Capital Gains Tax Reductions of 1978."

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